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Applied Materials Inc  
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EXAMINER

PADGETT, MARIANNE L

ART UNIT

PAPER NUMBER

1762

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79-3

Please find below and/or attached an Office communication concerning this application or proceeding.

A9-3

## Office Action Summary

Application No.

09/545,110

Applicant(s)

Lill et al

Examiner

ML. Padgett

Group Art Unit

1702

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

☒ Responsive to communication(s) filed on 4/6/00

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

☒ Claim(s) 1-106 is/are pending in the application.

Of the above claim(s) 4-6, 11-12, 29, 38-77 & 91-101 is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) 1-3, 7-10, 13-28, 30-37, 78-90 and 102-106 is/are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claim(s) \_\_\_\_\_ are subject to restriction or election requirement

## Application Papers

☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some\* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_

☐ Copies of the certified copies of the priority documents have been received

in this national stage application from the International Bureau (PCT Rule 17.2(a))

\*Certified copies not received: \_\_\_\_\_

## Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2

☐ Interview Summary, PTO-413

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other \_\_\_\_\_

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1. This application contains claims directed to the following patentably distinct species of the claimed invention: detection and determination of

- a. thickness;
- b. profiles or contours (trench depth or corners);
- c. compositions or materials on or in substrates;
- d. plasma emissions;
- e. start and stop of (unspecified) process (end point);
- f. microstructural;
- g. electrical.

It is also noted that a defined process, depending on what it was, some species such as (a) or (e) might or might not be different species, but for the present processes that are broad enough to include, for example a person washing dishes in their kitchen, the species designations are appropriate.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claims 1-3, 8-10, 13-14, 78-90 & 102-105 are generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

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Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

2. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

3. During a telephone conversation with Ashok Janah on 7/6/01 a provisional election was made without traverse to prosecute the invention of species (e) endpoint detection, claims 1-3, 7-10, 13-28, 30-37, 78-90 and 102-106. Affirmation of this election must be made by applicant in replying to this Office action. Claims 4-6, 11-12, 29, 38-77, 91-101 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

4. Applicant is advised that the reply to this requirement to be complete must include

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an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(I).

5. Claims 2-3, 14, 16-17, 26, 79, 82, 89 and 104 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. .

Claims dependent from an apparatus claims, such as 1, need to have limitations that further limit the structure of that apparatus, or they are not further limiting. For example, claims 2 and 3 are directed solely to method limitations that describe characteristics, or interactions of the light before it reaches the detector but the examiner can determine no structurally related features in these claims, that will further modify the claimed apparatus.

Also, note that the substrate material (s) treated in an apparatus are NOT part of that apparatus, thus features or materials of the substrate do not change or modify the structure of the apparatus.

There is no recognizable difference between the apparatus structure as described by claim 25 and that of claim 26. The action of evaluating in claims 79, 89 and 104 are purely method, and provides no structure to the apparatus, not provided for in the independent claim.

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6. Claims 1-3, 7,-10, 14, 20, 78-90 and 102-106 are objected to or rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Limitations that lack a correct article to properly or clearly indicate their antecedent basis, or lack thereof include “a substrate” (claim 1, line 4); “a change..” (claims 3 or 10, lines 2, see claims 2 or 9 from which they depend); “the substrate surface” (claim 3, line 4); “the chamber” (claim 8, line 7); “a property...” (claim 14, line 2); “the reflectivity” (claim 20, line 2, deleting “the” would correct this); and “the instruction signed” (claim 81).

In claims 86 or 106, which depend from 85 or 105, respectively, the requirement to provide instruction at the beginning of the process, to remove the substrate form the chamber or end processing, appears to be contradictory to the intent of the claims. If one removes the substrate before one starts, or ends the process before doing it, nothing is done. Clarification of phrasing or intent would be desirable.

In claim 102, the examiner is unclear what, if anything “factory automation host” provides to modify “computer”. All computers are automated. Factory is a place and not part of any computer. Where one chooses to use a computer is a method limitation, having no clear structural effect on the apparatus. What “host” is intended to refer to is unclear or unknown to the examiner.

In independent claims 78, 83 and 88, the initial limitation refer to just a single substrate, however the last lines, in the evaluation or controller steps are with respect to “a batch of substrates”, so the relationship between these singular and plural quantities of substrates are

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unclear. One possibility (logical, but not necessitated by the claim language), is that the batch represents a series of substrates to be processed one substrate of a time, but a batch is usually multiple substrates processed together, however the previous limitation denies that option.

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 8-9, 18-20 and 83-87 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the processes of polishing silver, as exemplified by the directions on the Jamestowne Silver Polish (See copy of label).

These claims are so broadly written and lacking in context, that they read on many processes done by the general population in everyday life. The polishing of silver has been chosen to illustrate this point, with the directions on the Jamestowne polish providing a formal reference for the process. Note that the process of removing the tarnish as described, inherently changes the reflectivity of the substrate, thus effecting the amplitude of the reflection. Applicant should further note that the person performing the process is working in the "process zone" and placed the substrate there (with the room in which it is done reading on a chamber). Before, during and after

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processing that person's eyes detect the light (which is not polarized) reflected from the substrate, because that is inherently how eyes biologically function. The human brain evaluates what the eyes detect, to determine whether or not all the tarnish has been removed, thus the beginning and end of the process, as instructed in the polishing directions. Note the directions provide the conditions for processing and when to stop. Furthermore, the human brain inherently stores information (memories), which are used to compare with the effects produced during the polishing, as per the instructions, and evaluate relative changes in reflection, hence amplitude, as caused by rubbing with the polish.

Alternately, while the directions on the silver polish bottle do not explicitly tell the person following there to look at what their doing and evaluate the effects, etc, it would have been obvious for one of competent workmanship to do so.

9. Claims 1-3, 7-10, 13-17, 22-28, 30-31 and 34-37 are rejected under 35 U.S.C. 102(b) as being anticipated by Kruppa et al.

Kruppa et al teach an automated thickness monitoring and control system, where a light source such as an AC tungsten iodine filament lamp (ie. a non-polar source) generates light collimated into a beam, which is reflected off a substrate (wafer 5) on which sputter deposition is occurring. The reflected light is passed through a polarizer and a filter to a photodetector, which generates and sends a signal. It is taught that the reflected light comes from both the surface of the wafer and from the film, with the intensity (ie. amplitude) dependant on the thickness of the sputtered film, because of light wave interference which goes through a succession of maxima and minima. Thickness and when to stop are calculated or determined by electronically counting the



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minima. See the figures; abstract; col. 1, lines 5-12 and 34-63; and col. 2, lines 39-66. Figures 3A and 3B show maxima and minima as measured by Kruppa et al's photocell without and with, respectively, filtering out background light by polarization (col. 3, lines 19-25). The curve of 3B is taught to be "preferable for measurement purposes", but this teaching does NOT exclude use of the 3A curve. The background on col. 1, lines 23-31, indicates that the 'background light' comes from the sputtering system, hence both light from plasma sputtering and the lamp are detected if and when 3A is used, and the signal generated and manipulated contains both. Note in Fig. 2, multiple detectors/photocells are used, with each generating a signal, hence the requirements of a first and second, ie. 2 probably different signals is met.

Figures 4 and 5, show the schematic for the electronic device that receives, records and manipulates the signal from the detector, with "minima select switch 41" preset to the desired thickness represented by some number of minima. This may be considered programming (col. 3, lines 37-col. 5, line 12). A computer is defined as "a programmable electronic device that can store, retrieve and process data" (Webster's 9th New Collegiate Dictionary), hence while primitive by the standards of today, this disclosure reads on a simple computer, where the electronics produce a memory and a program, etc. as claimed.

With respect to the apparatus, it is noted that the actual source of the radiation seen by the detector, i.e. reflected or direct light, is not significant to the apparatus structure, as long as the capability to detect light from appropriate configurations is present. Similarly, whether the point detected is the beginning, middle, end, etc., of the process is irrelevant to the apparatus structure being a method consideration, as long as the capability to choose to determine any point in the

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process is present. Kruppa et al fills this requirement, as can be further seen by their teachings of alternative uses, such as with etching or other deposition processes (col.5, lines 13-30).

10. Claims 18-21, 32-33, 78-90 and 102-106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kruppa et al discussed above.

Kruppa et al do not discuss determining the onset of the process, however it would have been obvious to one of ordinary skill from Kruppa et al's disclosure of determining coating or etching end parts, that any desired change in or lack of change in thickness would have been determinable from the process, because they are all derived from the same sets of information, where no change means not yet started, and any change indicates onset of the process, and will be shown on the lamp display 39.

Kruppa et al do not discuss treatments of series of substrates, which may be what the claimed "batch of substrates" represents (see 112 rejection in section 6), however use of processes in assembly lines ,i.e. to produce multiple products consecutively, is recognized as an obvious use and variation of any process, hence would have been obvious to apply to Kruppa et al's process for standard economic and production reasons.

Kruppa et al does not disclose a "factory automation host computer" , what ever that may be (figure 9, re #300 would appear to indicate it only receives output, but page 30 and claim 104 also indicate output/control ability), but they do have the makings of a basic computer with process control capabilities that may be considered to read on this term of uncertain scope.

Alternately, it would have been obvious to one of ordinary skill in the art to update the 1968 automation teachings of Kruppa et al, to use modern computer controls in the deposition process,

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because such instrumentation is what's been available for quite a few years, and because software control is more flexible than hard ware control, generally making it easier to modify or change a product for different desired outputs or optimization.

11. Claims 1-3, 7-10, 13-28, 30, 78-80, 82-85 and 87-90 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Busta et al.

Busta plasma etches and determines the end point and thicknesses involved via use of reflected and refracted light from light source 30, where polarizing filters 34 and 35 may, or may not be employed (abstract; figures; col 1, line 58-col. 2, line 16 and line 46-col. 4, line 44, esp. Col. 3, lines 30-36 and 53-col. 4, line 5 and lines 34-37). Note the background discusses how the glow discharge of the plasma inherently changes color intensity during the etching process due to changing layer thickness (col. 1, lines 27-47). Note the resulting strip chart recorded by the process will show, hence detect both the start (onset) and stop of the process, as well as radiation from the plasma if not filtered out. Col. 2, lines 1+ note the use of computer programs with detectors, with col. 4, lines 34+ discussing control circuits for automation cut off. Note in none of these claims is how first and second signals are or are not distinguished or distinctly defined, hence may be arbitrary.

While Busta et al does not discuss "determining an onset of processing an underlayer while an over layer is being processed," it is apparent that the completion of the latter occurs at the start of the first, i.e. they occur simultaneously at the interface of the layer. Besides one can not determine that something has occurred, before it takes place.

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12. Claims 81, 86 and 102-106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Busta et al.

Busta does not disclose providing an instruction signal at the beginning of processing, however what this signal is provided to is not clear, but use of computer, control circuits and applicably to various processes with differing etching variables are taught. It would have been obvious for one of ordinary skill in the art to input or instruct the control/program for the particular process desired at the start of each batch or procedure in order to tailor the process to the specific materials and end uses, as implied in col. 4.

While no "factory automation host computer" is discussed, it would have been a matter of competent engineering to incorporate the process computer of Busta into the overall assembly line and its automatic control/computer for the particular product being formed, since otherwise a problem or change in are step on an assembly line would not be taken into account in later steps, etc.

13. Claims 1-2, 7-9, 13-20, 22 and 78-90 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Christol et al .

Claims 102-106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christol et al .

In Christol et al, see the abstract; the figures, esp 1, 3, and 4; col. 2, lines 63-col. 3, line 19 and lines 29-65; and col 4, lines 14-65, for use of polychromic light from an incandescent source, to reflect off a substrate being processed (application or removal, any material so long as sufficient optical contrast exist between layers), exemplified by etching. The reflected light is

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measured, and the signals produced by the detector are used to determine commencement and end points of the etching. Christol et al do not discuss a "...host computer", however as above integrating into an assembly line of the individual process and its computer as represented by Christol et al's teaching, would have been obvious as conventional automation procedures.

14. Claims 1-3, 7-10, 13-28, 30 and 78-90 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Brooks Jr. et al.

Claims 31-37 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Brooks, Jr. et al .

Claims 102-106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brooks, Jr. et al.

In Brooks, Jr. et al , see the abstract; figures 1, 3 and 4; summary; col. 3, lines 11-31 and 43-55+; col. 4, lines 15-34; col. 5, lines 1-col. 6, lines 68, esp. col. 5, lines 20-45 and 67-68+, and col. 6, lines 10-29 and 54-68; and col.7, lines 8-29, for end point detection in plasma etching of substrates with multiple layers, using reflected laser light whose intensity (amplitude) is detected by photodiodes. Figure 3 illustrates the various reflected components of the light detected in which interference will occur. Figure 4 shows the voltage waveform for the analog signals of the light, which are sent to the microprocessor, which may use them to automatically detect the endpoint, including via time derivatives of the signal. Detected data may also be compared to a run on a test wafer, so that prior instructions can be given for when to terminate.

Brooks et al does not discuss whether or not the light emissions from the plasma are detected, however as RF plasmas inherently produce light, and no filters are used before the

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detectors, all signals would have been expected to inherently include plasma emission light, as well as reflected light. Labeling any signals first and second is arbitrary for the claims as written, hence has no significant meaning as written. Alternately, as it is known that RF plasma produce a glow which might be considered background radiation, and Brooks et al teach filtering the data signals (ref. #30), as well as comparative processing (col. 6, lines 54-68), it would have been obvious not one of ordinary skill at data massaging to take initial readings on the plasma before etching or reflections occur, so that superfluous light emissions can be subtracted or filter from the data signals. While none of the claims necessitate any such action or capability. Their very broad and critic language can be said to read on such a typical error correction procedure, i.e. the subtraction of extraneous light emissions not related to the property or particular light being measured.

Again "...host computers" are not discussed, but would have been obvious for reasons discussed above.

15. Claims 1-3, 7-10, 15-21, 23-28, 30-35 and 78-87 are rejected under 35 U.S.C. 102(b) as being clearly anticipate by Schoenborn.

Claims 102-106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schoenborn.

In Schoenborn, see the abstract an figures, esp. 2-6; col. 3, lines 1-5 and 22-47; col. 5, lines 1-13 and 35-col. 6, line 66; col. 8, lines 32-48+ (single or batch processing); col. 10, lines 19-39+; col. 11, lines 48-col 12, line 62 and col. 13, lines 3-24 for a film monitoring technique useful in either etching or deposition, which employs real-time (continuous; thus 1st , 2nd, etc..

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signals) detection of plasma emission intensity, which is inclusive of light emissions reflected from film, substrate, etc., and interference phenomena. The continuous derivation/monitoring of the thickness as illustrated by fig. 4, indicates effective determination of the onset of the process, and explicit discussion of end point applications are present. Figure 6B shows a flow chart for in-line-analysis (col. 7, lines 45-50), which indicates the presence of an analysis module, ie. a controller, with extensive discussion of analysis procedures, however actual use of a computer(s) is never actually mentioned, just generic references to "an in-line-analysis module" or "today's advanced process equipment", but one of ordinary skill in the art would have immediately recognize that the kind of equipment or modules necessary to handle the in-line real time analysis and control would have been computers and their program codes, hence such would have been obvious as the typical (only) means available from implementing the taught procedures. Overall integration of the individual coating or etching process into a computerized automated assembly line network, would have been obvious as previously discussed.

16. The patents to Maung et al, Kleinknecht et al and Habegger have teaching as equivalent to above applied references, except for applying to plasma emission radiation limitations, but are redundant in view of the above rejections.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M.L. Padgett whose telephone number is 703-3087-2336 on Monday-Friday from about 8 am-4:30 pm and Fax #(703)872-9310 (regular formal); 872-9311 (after final); and 305-6078 (informal). .

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Beck, can be reached on (703)308-2333 .

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661 .

MLPadgett:evh

6/28/02

7/3/02

A handwritten signature in black ink, appearing to read "Marianne Padgett", with a long horizontal line extending to the right.

MARIANNE PADGETT  
PRIMARY EXAMINER  
GROUP 1700